

XXIV. *On the genus Acentropus.* By J. W. DUNNING,
M.A., F.L.S., &c.

[Read August 7th, 1878.]

IN the "Transactions" for 1872, the Society did me the honour to publish a paper "On the genus *Acentropus*," in which, after reviewing the arguments on the question whether the genus was properly referred to the order *Lepidoptera*, discussing its true position in that order, and collecting the scattered observations on the habits of *Acentropus*, I proceeded to consider how many known species there were of the genus; and the conclusion to which my arguments tended was, that *A. niveus*, *Hansoni*, *Garnonsii*, *badensis*, *germanicus*, *Nevæ*, *obscurus* and *latipennis*, were all referable to the same species.

In the "Tijdschrift voor Entomologie" for 1876, p. 1, Heer Ritsema, writing in June, 1875, whilst agreeing that *Garnonsii*, *badensis*, *germanicus*, *Nevæ* and *obscurus* were not entitled to specific rank, and that *A. latipennis* was identical with *Zancla Hansoni*, nevertheless thought there were two distinct species, of which, whilst the males were undistinguishable, one (*A. niveus*, Oliv. = *A. Garnonsii*, Curt.) has a female with rudimentary wings, and the other (*A. latipennis*, Mösch. = *Zancla Hansoni*, Ste.) has a female with fully-developed wings.

In the Proc. Ent. Soc. 1876, p. xxxii, I criticised the reasoning upon which this conclusion was based, and ventured to hazard a conjecture that if Ritsema would persevere in breeding the insect he would obtain both forms of female from larvæ collected at the same spot.

In the Tijd. v. Ent. for 1878 (pp. 81—114), Ritsema returns to the subject, and has now published a life-history of *Acentropus* in its various transformations. In this article the author abandons his former position, describes and figures the fully-winged and the rudimentarily-winged females as two forms of one and the same insect, and has arrived by direct observation at the very conclusion to which I had theoretically arrived in 1872. This memoir,

though published only in 1878, is dated "December, 1875;" it contains the result of the author's experiments from 1870—75 and no later; so that my prediction of 1876 was no prediction at all, as Ritsema had in fact done in 1875 the very thing which, in ignorance of his observations of that year, I had prophesied he would do.

The following is a short recapitulation of Ritsema's experiences (Tijd. v. Ent. xxi. pp. 81—92):—

On the 14th June, 1870, he first captured the insect (a dozen, all males), at a fish-pond called Kolkje, not far from the village of Overveen, near Haarlem, where it had been previously found by Weyenbergh. On that occasion he searched in vain for larvæ, but a fortnight later he found, on *Potamogeton crispus*, in the angle of the leaves against the stem, some white silken cocoons which contained the empty skin of a pupa, having on each side three prominent stigmata. On the 14th July, he found in similar webs some unhatched pupæ; and on the same day a full-grown larva which was busy spinning up. In August he collected more larvæ, which, however, differed considerably in size; he placed them in an aquarium on *P. crispus*, and they remained in the larva state throughout the winter.

At the end of March and in April, 1871, he collected more larvæ, and placed them with the others. At the end of April some of them began to spin, whilst others had not attained half their growth. But about the middle of May, Ritsema went from home, and on his return, plants, larvæ and pupæ were all dead. He had, however, sent a full-grown larva to Heer Brants, which, in the latter half of June, produced a female moth, furnished with rudimentary wings; and this was all that resulted in the season of 1871.

On the 12th May, 1872, Ritsema went again to the Kolkje, and found not only larvæ and pupæ in sufficient numbers, but specimens also of the male imago. Several male moths having previously emerged from the pupæ, on the evening of the 26th May a female was observed moving quietly over the *Potamogeton*, under water; this also had only rudimentary wings. On the next day Ritsema left home, and on his return there was a repetition of the catastrophe of the previous year—plants, larvæ and pupæ were all dead; there were, however, in the aquarium several dead moths, all males but one, and the one female possessed only rudimentary wings.

Nothing more was done in 1872, and nothing at all in the following year. But in the summer of 1874 Ritsema was staying at Velp, near Arnheim, and in the latter half of August he collected thirty moths, all males, and found both larvæ and pupæ on *Potamogeton crispus*. Shortly before, a fully-winged female *Acentropus* was captured by Father Aghina, in the neighbouring Dominican convent at Huissen; it came in the evening to the light of a lamp, and flew wildly round over the table.

Upon this Ritsema writes (p. 87):—"It is to be noted, also, that in the places where I had collected numberless males of *niveus*, I had not found a single similarly normally-winged female, and from larvæ from one of these places had bred only rudimentarily-winged females; thus it will be seen that the circumstances were very apt to corroborate my idea that the two forms of female did not belong to one species, and to incite me in the following year to breeding from larvæ from the Kolkje, in order to endeavour to obtain proof of my idea."

Accordingly, on the 20th April and the 4th May, 1875, Ritsema again went to the Kolkje, and collected some five-and-twenty larvæ; on the 20th May he obtained two more full-grown larvæ and fifteen pupæ. On the last occasion he also found three dead moths, one male and two females, both with rudimentary wings. During the journey home, a female hatched, in the bottle in which the larvæ and pupæ were carried, and this, too, had only rudimentary wings. When placed in the aquarium, she swam with the help of the long fringes of her middle and hind legs, in an almost perpendicular position, with the head upwards, pushing and jerking round, until at last she fixed herself, by her fore feet and by curving her abdomen, under water on the stalk of one of the plants. Later in the evening, by lamp-light, this female was seen swimming round over the surface of the water, keeping the tip of her abdomen turned upwards. On the 29th May, ten moths hatched, three males, and seven females, all with rudimentary wings; they always emerged in the evening, and the females swam round and round, both on and in the water. On the 1st June, two males and two females hatched, the latter with rudimentary wings; and on the following morning the males were seated above the surface of the water upon the stems of the plants, and the females under water on the *Potamogeton*

leaves, holding themselves fast by their fore feet, and having the abdomen bent round the leaf. On the leaves were discovered numerous oval greenish-yellow eggs, placed in regular rows side by side; and on the 16th June the first larvæ came out of these eggs, others continued to hatch for about a week, but half the eggs were attacked by a fungus and proved unproductive.

Altogether, from the larvæ and pupæ (forty, more or less) collected at the Kolkje, Ritsema bred eighteen moths, five males and thirteen females. Of these females, and of five more, captured at the same locality, making eighteen in all, not a single one had fully-developed wings, though amongst them there was some difference observable in the extent of development of those organs.

But on the 3rd July, 1875, Ritsema went again to the Kolkje, and in addition to twenty-six males he found a normally-winged female *Acentropus* floating dead upon the water, and soon took four more in the same situation. On careful examination these females were found to agree with Aghina's specimen captured at Huissen. On the 8th July he went again to the fishpond, and found more normally-winged females, thirteen in all. Thus far, then, of these females from the same pond, exactly one-half had rudimentary wings, and the other half were fully winged.

Upon this Ritsema writes (p. 92):—"The discovery at the Kolkje of normally-winged females which agree with *A. latipennis*, had shaken my faith in the existence of two species which should each have its own form of female, and made me incline to Dunning's view (the existence of one species with two forms of female), a view which was supported by a thorough examination of all the specimens collected by me, as well males as females, and was shared by our Micro-Lepidopterist, P. C. T. Snellen."

Of the larvæ born in June, from eggs laid by the rudimentarily-winged females which had come from hibernated larvæ, some were fully grown in August, and began to spin up, having thus taken about six weeks to attain their full size. On the 23rd August a male imago appeared, and on the following day a second male; and these were all the moths which emerged from that batch of eggs in 1875. The rest of the larvæ hibernated. The larvæ taken out of the pond on the 8th July produced four moths between the 17th August and the 15th September; of these, three were males, and one was a female with

rudimentary wings, but she died without having laid any eggs.

Here the author's record ends; for the paper (dated, as already mentioned, in December, 1875) tells us nothing of his observations in 1876 or 1877. And the result seems to be, that out of thirty-seven females from the Kolkje in 1875, some captured and some bred, but all from the same pond, nineteen had rudimentary wings, and eighteen were fully winged.

The mode of life and the different states are described on pp. 93—105 of the *Tijdschrift*.

The oval yellowish-green eggs are laid under water, in regular contiguous rows, on the under side of the leaves of *Potamogeton*. In a fortnight, or thereabouts, the young larvæ emerge, and soon begin to feed. Ritsema says (p. 95), that "in the course of a few days some of the larvæ bore into the stalk, or the mid-rib of the leaves, and therein gnaw passages. At what period of their existence they abandon these passages I cannot exactly say, but it is only in their youth that they remain therein." The greater part of the larvæ remain upon the leaves, bend the upper end thereof down, or bite a more or less semi-circular piece out of the edge, spin it fast on the disc of the leaf, and bestow themselves in the habitation thus formed, feeding on the leaf that falls within their reach. Later on, the larva forms a dwelling by spinning together two leaves, usually at the upper end along the edges. The larvæ never leave the water voluntarily. When young they grow very slowly, afterwards more quickly but unequally, so that they gradually begin to differ remarkably in size. After about six weeks some attain their full size, and spin up. The cocoon is placed below the surface of the water, against or partly on the stem of the plant, usually in the axils, but sometimes on the under side of a leaf; it is white and stiff, covered on the outside with pieces of leaf, or by the leaf in the axil of which it rests.

The pupa is of a clear brown colour, darker on the upper than the under side, having three pairs of protuberant conical stigmata or spiracles, a pair on each of the 2nd, 3rd, and 4th abdominal segments. The female pupa is distinguishable from the male pupa by its stouter build, and by a slight difference in the knobs or hooks on the under side of the anal segments, and is furnished with full-sized wing-cases in both the forms of female; but in

a pupa which will produce a female with rudimentary wings only a small part of the wing-case is occupied, as may be clearly seen shortly before the moth emerges, when the wings are easily distinguishable by their darker colour. The duration of the pupa state of existence is about three weeks.

The greater part of the larvæ, however, hibernate; this they do in various stages of growth, and about the end of March they become active and spread themselves over the food-plant: by the end of April some spin up, and about the middle of May the first brood of the imago begins to appear. A second brood appears in July, and a third in August and September. The spring brood are all from hibernated larvæ, which may be the offspring of any of the three broods of the preceding year. The summer brood, also, are all from hibernated larvæ, and Ritsema conceives that it is to this brood, and this alone, that the normally-winged female belongs, and that the larvæ which are their offspring all hibernate; whilst the autumn brood is from larvæ the offspring of the spring brood of the same year, some of which thus rapidly mature, whilst others of them hibernate (cf. Ent. Mo. Mag. xii. 257). Hence it follows that amongst the larvæ hibernating in any winter there are or may be offspring of all the three broods of the previous year.

I do not quite gather whether the author supposes the females of the summer brood to be always amply winged, or whether both forms of female occur in this brood. But, however this may be, the theory that the female with rudimentary wings belongs to the spring and autumn broods, and that the amply-winged female belongs exclusively to the summer brood, requires further examination. If this be the true view, it would seem that rapidity of larval growth is unfavourable to the alar development of the female imago: it is the larvæ which hibernate earlier in life, and take the longest time to feed up in the spring, which produce the brood of females with fully-developed wings.

Ritsema did not meet with an absolutely apterous female, but the partially-winged and the amply-winged forms were equally fertile and productive.

The imago is described at length (pp. 100—105) by Snellen. Of males he had before him fifty-eight specimens captured and bred by Ritsema, varying in expanse of wing from 11—16 mm., the majority ranging about

13 mm., and the smallest examples having the fore wings more sharply pointed than the larger ones. Of females, he had before him twenty-two specimens, seven with developed wings and fifteen with rudiments only, the rudimentary wings varying in length from one quarter to one half the length of the abdomen: all the females were larger and more stoutly built than the males, and the fully-winged females were 17—18 mm. in expanse. After an elaborate examination of the insect in all its parts, and whilst admitting that one cannot be astonished at Olivier's having taken it for a *Phryganea*, Snellen thinks that, when once its Lepidopterous affinities were pointed out by Westwood, "obscure ideas respecting the distinctions of the orders of insects, and perhaps a love of contradiction" (p. 106), must have been the main causes for contending that the creature is Trichopterous. "The more accurately the perfect insect is examined, the stronger root does the conviction take, that we have to do with a pretty normally-formed moth, which has comparatively much less congruity with a Phryganid than have some other *Lepidoptera*, e.g., the *Micropterygina*. Although there are only rudiments of a sucker, the form of the labial and maxillary palpi plainly shows relationship with the Pyralid genera, *Chilo*, *Scirpophaga* and *Schœnobius*; the form of the wings, moreover, agrees with that of the two last-named genera, the clothing of the wings is perfectly Lepidopterous, and finally, when the neuration is looked to, it is seen most plainly that this is wholly and indubitably that of the *Pyralidæ*." The supposed absence of spurs on the mid- and hind-legs, which suggested the name *Acentropus*, would have been a wide departure from the Pyralid type; but now that the spurs have been shown to exist, this difficulty is removed. And I imagine it may now be regarded as finally settled, that the *Acentropodidæ* must take their place as a family of *Pyralidina*.

Snellen mentions (p. 108) that two English specimens, and five Russian received from Baron von Noleken, have passed through his hands, and he can come to no other conclusion than that all belong to one species, which he holds to be Olivier's *Phryganea nivea*. As to the seven species of von Noleken, Snellen remarks that all the arguments as to specific distinctness based on the females with perfect wings and the females with rudimentary wings must fall to the ground before the observations

of Ritsema, and that *Hansonii*, Ste., *Garnonsii*, Curt., *Nevæ*, Kol., *badensis* and *germanicus*, Nolek., must all be united as synonyms with *niveus*, Oliv. He then proceeds (p. 109) to discuss the claim of Möschler's *latipennis*, and shows (as Brown had previously noted) that three out of the six points of difference relied on by Möschler and Herrich-Schäffer are precisely the points in which the sexes of *A. niveus* differ from one another, whilst the other three are not really differences at all, but each occurs in specimens that are undoubtedly *niveus*, and each in others that are undoubtedly *latipennis*; and he adds, that a male of *latipennis* from Sarepta, which he received from Staudinger, was found, on examination, to differ in no single part from Dutch males of *niveus*. "It is, indeed, somewhat more broad and stumpy-winged than the smallest *niveus*; but, compared with the largest specimens, which are connected with others by the gentlest transitions, I find that the latter are even more stumpy-winged than *latipennis*." Finally, Snellen concludes (p. 110) that the claims of *latipennis* to specific rank have nothing but loose screws to rest upon, and that the opinion is well-founded that all the hitherto-described forms of *Acentropus* compose but one species.

Ritsema yields to Snellen, and, in addition to figures of the egg, larva, pupa (Pl. V.) and male imago, with numerous details, he figures (Pl. VI.) both the amply-winged and the rudimentarily-winged female as two forms of *Acentropus niveus*. [Some of the numbers on Pl. VI. do not correspond with the explanation of the figures on pp. 113, 114 of the text.]

On the question of the presence or absence of ocelli (*vide* Tr. Ent. Soc. 1872, p. 129) Ritsema is silent. Snellen speaks of their absence; whilst, as to tibial spurs or spines (*vide ib.* p. 130), Snellen corroborates the observations of Noleken, Speyer and Westwood, that the spurs, though small and difficult to discover, do really exist.

It will be remembered that Reutti observed (*vide ib.* p. 138) that the wingless female swims on her back under water by night, that coition takes place in the water, the female laying hold of the male and dragging him down with her. Ritsema, however, says (Tijd. p. 95) that "the pairing appears to take place soon after the emergence of the moths, on the surface of the water;" and he suggests (p. 89, n.) that the pair observed by Reutti had been

alarmed by something or other, or that the female had dived down for the purpose of getting rid of the male.

Ritsema, however, never saw an actual case of copulation, though he was once very near it. But I will give his own words (p. 89, and compare Ent. Mo. Mag. xii. 257):—"At last fortune favoured me, at least so far that, in the evening of the 1st of June, two males and two females hatched, the latter with rudimentary wings; but it was so stormy that evening that I feared I should be unable to observe the copulation if it took place. When in the course of the evening I visited the aquarium, which stood in the garden, it was impossible to hold the lantern for more than a moment, which, however, was just sufficient to see that the males were very nimbly hovering round the females, chasing them on the surface of the water. As the storm continued its violence, I visited the aquarium no more that night. But I had seen enough to make me suppose that copulation takes place, not *in*, but *on*, the water, and that the female dives down to lay her eggs upon the food-plant."

Ritsema assumes that Reutti's account is the result of a single observation, and omits to notice that Reutti's statement is confirmed by Wallengren. It may be that the latter author merely reproduces the former's statement without acknowledgment and without having verified the fact. But if so, how stands the matter?

Ritsema's momentary glance by lantern light on a stormy night was the one solitary opportunity he had of making any observation on this subject, and all he can say is, not that he saw them *in copulâ* on the water, but merely that he saw enough to make him suppose that the act takes place on the surface of the water. Even if his momentary peep revealed them *in copulâ* on the surface, there is nothing to show that the next moment the female did not, as Reutti says, draw down the male with her. And, granted that the act was completed on the surface, we have only one observation by Ritsema against one by Reutti. The most that can at present be said is, that Reutti's observation has not been confirmed by Ritsema.

The larvæ and pupæ live in the water, so that all the moths are born in the water. And Ritsema tells us that the first female found in his aquarium was quietly crawling over the *Potamogeton*, under water; that another female, born in a bottle of water and thence turned into the aquarium, swam about freely and came to rest on the

plant below the surface; whilst the other females which he bred were observed swimming both on and in the water; and lastly, that the female dives down to lay her eggs under water on the *Potamogeton* leaves, and that, after laying them, she remains under water on the leaves. In short, the female with rudimentary wings dwells principally under water; and though the male is not quite so amphibious, he seems to have no objection to a dive (*vide* Tr. Ent. Soc. 1872, p. 138). Reutti, as reported by Heinemann, says that the female swims on her back under the water; and on this point there is a direct conflict between him and Ritsema, for the latter says that in the evening the female comes to the top and swims about on the surface, with her abdomen turned upwards. And it seems more probable that she should thus attract the males, which sit sluggishly by day on any object near the water and fly briskly in the evening over the surface of the water. But having thus attracted her mate, there is nothing in Ritsema's observation to negative Reutti's account of her drawing him down into the water with her. The subject requires further investigation as regards the wingless female; whilst, as regards the winged form, no one has yet been fortunate enough to detect her *in flagrante delicto*.

On the main point, the specific identity of the two forms, I think no reasonable doubt remains; but it is to be hoped that Heer Ritsema will continue his observations, since there are many, and I am one, who will be satisfied with nothing short of absolute demonstration, by breeding both forms of female from the same batch of eggs, or, which would be equally conclusive, rearing *laticornis* females from eggs laid by a *niveus* mother.